

## The Place of Wireless

Wireless has been well received ever since the first wireless radio transmission over the Atlantic Ocean by Marconi almost a century ago. Since that time the technology has been harnessed to suit a myriad of applications.

It is convenient to divide applications based upon coverage area or range as shown in Figure 1. Based on the definitions of this figure an application that requires coverage area of around 100m falls into the Wireless Personal Area Network (PAN) category; an application that required coverage area of around 250m falls into the Wireless Local Area Network (LAN) category and so on. Within each category several technologies exist.

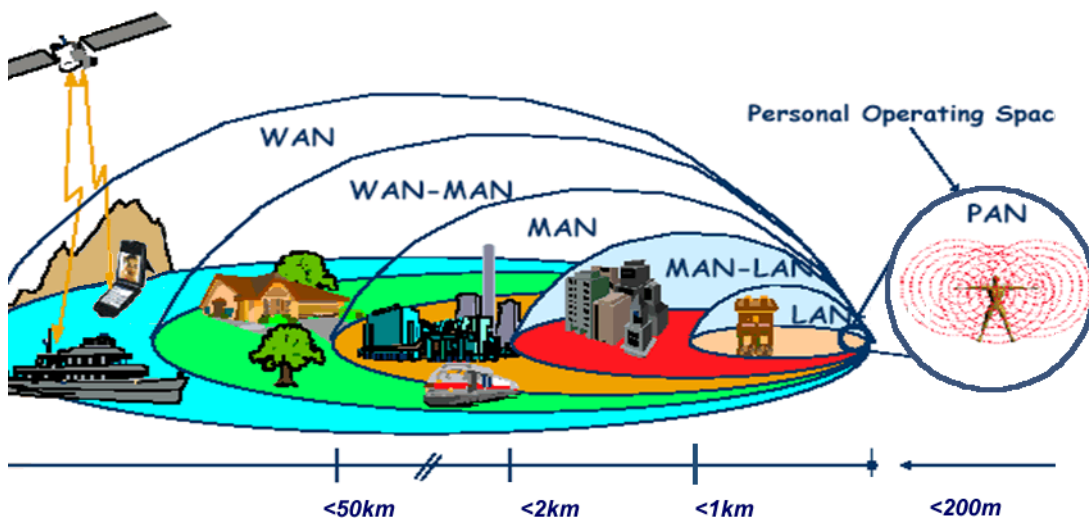


Figure 1: Wireless Operating Range<sup>1</sup>

We are all familiar with the use of WAN technologies such as the various commercial telephony standards such as GSM, GPRS, CDMA, EDGE or UTRA. Other standard gaining in familiarity are MAN standards promoted by the IEEE such as IEEE802.16 and IEEE802.20. Older standards such as HomeRF and trunk radio are also well known. Each different and each suited to different applications.

For the purpose of this article however we will focus upon the LAN/PAN space where the applications revolve around connection of devices within close proximity. For LAN applications this is in the order of 200-300m; for most PAN applications 10m is more than sufficient.

Some applications will have a relatively fixed network structure in that devices will tend to either stay or return on a regular basis to the network. Other applications will consist of more fluid networks requiring short term adhoc connection.

<sup>1</sup> Figure 1 has been modified but not developed by Clarinox, the original source is unknown to the author

Technologies in this close proximity space include 802.11 a/b/g, UWB, Zigbee, RFID and Bluetooth.

802.11 a/b/g is a strong technology and ideal for replacing Ethernet cabling to create wireless networks, LAN applications where high data rates are of premium consideration and the power cost of this is not a significant concern.

UWB has significant potential. It uses pulses or waveforms compressed in time to spread frequency energy over a very wide bandwidth to very low levels (even under the thermal noise floor.) This may allow UWB radios to share spectrum with existing narrowband broadcasters without causing undue interference. This potential is yet to be realized.

Zigbee is an upcoming low-rate technology that will define the network, security and application interface layers. The main market predicted for Zigbee is the home automation market.

RFID is a useful, low price, close proximity, very low data rate technology. It alone does not support the level of complexity required to facilitate complex solutions however it can form an important part of complex applications.

Bluetooth technology is ideal for networking of all sorts of electronic devices within 100m of each other. In fact several classes of Bluetooth device exist to provide for different coverage areas; these are class 1, 2 and 3 providing 100m, 30m and 10m respectively.

A distinguishing feature of Bluetooth is the sophisticated service discovery mechanism that allows for devices to establish connection, transfer data and disconnect without requiring user intervention. User approval may however be required for security purposes. Bluetooth has elaborate security mechanisms built in.

Bluetooth also caters for many devices to co-exist in the same region. These may be part of the same piconet, they may be connected in scatternet topology, or may have no connection to each other at all. Whichever is the case they can co-exist without interfering with the operation of each other.

The standard defines all layers of the OSI protocol stack layer which translates to a focus on application development inherent in the specification design.

The Bluetooth low power rates of around 1mW Class 3 (100mW Class 1) during transmission make it suitable for use for handheld devices. Added to this are various low power modes utilized during idle periods which can be under the control of the application.

A data transfer rate of 1Mb/s is sufficient for many voice and data applications including MP3 streaming and slow scan video. The new Enhanced Data Rates Improvement (2 and 3 Mb/s) will facilitate more audio video applications.

The Bluetooth technology grew from a desire to have a wireless headset for a mobile phone but it was soon realized that cable replacement has much greater general appeal.

The recognition of the broad range of usage models led to many application definitions, known as profiles, to be set by the body governing the standard, the Bluetooth Special Interest Group.

To date commercial applications have focused on a single use scenarios. Even if multiple profiles are provided in a device it is the usual expectation that these will be accessed sequentially. This expectation is being challenged as users ask “How can I use more than one application simultaneously?”

People want, for example, to be able to talk using their headset while synchronizing the phone’s calendar with that of a laptop. People will want to talk using handsfree while communicating with entertainment or data acquisition devices within their car.

The future is to be able to have complex systems and complex usage models. Usage models requiring multiple simultaneous profiles. It is only in this way, the true utility of the Bluetooth specification will be realised - and the true expectation of users met.

To date very few implementations of the Bluetooth protocol stack make this possible.

**References:**

<http://bwrc.eecs.berkeley.edu/>

<http://ieee802.org/>

Various web forums

TCS presentation to Monash University Dec 2003

**About the author:**

Trish Messiter is Director of Business Development for Clarinox Pty Ltd. Clarinox has an interest in wireless from a number of aspects. From a skill set including embedded system design, RF design and software development, Clarinox has focused on PAN wireless technologies, particularly Bluetooth. The Clarinox implementation of the Bluetooth protocol includes the ability to facilitate multiple simultaneous profiles. Additionally Clarinox is the Australian agent for REMCOM RF simulation and propagation analysis software. For more see [www.clarinox.com](http://www.clarinox.com)